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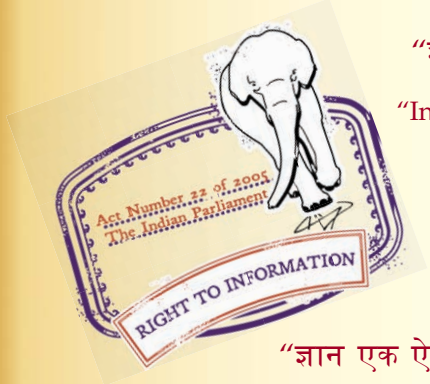

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SPECIFICATION FOR ANTIWEAR HYDRAULIC OIL

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(*Continued on page* 10)

Indian Standard

SPECIFICATION FOR ANTIWEAR HYDRAULIC OIL

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 10 May 1983, after the draft finalized by the Lubricants and Related Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

0.2 Antiwear hydraulic oils are generally used for the lubrication of axial, piston, vane and gear pumps. These oils are especially required in systems where both piston and vane pumps are used for heavy duty service. These oils may also be used for lubricating light loaded gears and bearings. These oils are not intended for use in hydraulic systems containing silver plated components.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

---

1. SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for antiwear hydraulic oil intended for use in all axial, piston, vane and gear pumps.

2. GRADES

2.1 The material shall be available in five viscosity grades, namely, VG 32, VG 46, VG 68, VG 100 and VG 150.

*Rules for rounding off numerical values (*revised*).

3. REQUIREMENTS

3.1 General — The material shall be made from refined mineral base stocks of high viscosity index and shall contain suitable additives to give satisfactory performance. It shall be clear and free from water, dirt and suspended impurities.

3.2 The material shall also comply with the requirements given in Table 1 when tested according to the methods prescribed in 'P' series of IS : 1448*. Reference to the relevant test methods is given in col 8 of the table.

4. PACKING AND MARKING

4.1 The material shall be packed in containers of metal or any other suitable material as agreed to between the purchaser and the supplier.

4.2 The containers shall be securely closed and marked with the name of the manufacturer; name, grade and mass of the material; recognized trade-mark, if any; and identification in code or otherwise to enable the lot of consignment or manufacture to be traced back.

4.2.1 The containers may also be marked with Standard Mark.

4.2.2 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

5. SAMPLING

5.1 Representative samples of the material shall be drawn as prescribed in IS : 1447-1966†.

5.2 Number of Tests

5.2.1 Tests for determining all the characteristics given in Table 1 shall be conducted on the composite sample.

5.3 Criteria for Conformity — The lot shall be declared as conforming to the requirements of the specification if all the test results on the composite sample meet the relevant specification requirements.

---

*Methods of test for petroleum and its products.

†Methods of sampling and test for petroleum and its products.

TABLE 1 REQUIREMENTS FOR ANTIWEAR HYDRAULIC OIL

(*Clauses* 3.2 *and* 5.2.1)

Sl No.	Characteristic	Requirement					Method of Test, Ref to (P :) of IS : 1448*
		Grade VG 32	Grade VG 46	Grade VG 68	Grade VG 100	Grade VG 150	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Kinematic viscosity at 40°C, cSt	28·8 to 35·2	41·4 to 50·6	61·2 to 74·8	90 to 110	135 to 165	P : 25
ii)	Viscosity index, *Min*	← 90 →					P : 56
iii)	Pour point, °C, *Max*	− 3	− 3	0	0	0	P : 10
iv)	Neutralization number, mg KOH per g of oil, *Max*	← 1·5 →					P : 1
v)	Flash point, cleveland open cup, °C, *Min*	180	180	210	210	230	P : 69
vi)	Rust preventing characteristics	← Shall pass the test B after 24 hours →					P : 96
vii)	Foaming test:						P : 67
	Foam stability after 10 minutes settling time, foam; ml						
	a) At 24°C *Max*	← Nil →					
	b) At 93°C *Max*	← Nil →					
	c) At 24°C after cooling down from 93°C *Max*	← Nil →					
viii)	†Oxidation test:						
	Hours to reach acidity of 2 mg KOH/g of oil, *Min*	1 000	1 000	1 000	1 000	750	P : ‡
ix)	†Pump wear (Vickers 104C pump test);						P : §
	Total ring† vane loss, in 250 hours, mg, *Max*	← 100 →					
x)	Copper strip corrosion for 3 hours at 100°C	← Not worse than No. 1 →					P : 15
xi)	Emulsion characteristics, *Max*	← 40-37-3 (20) →		← 40-37-3 (30) →			P : 91

(*Continued*)

TABLE 1 REQUIREMENTS FOR ANTIWEAR HYDRAULIC OIL — *Contd*

Sl No.	Characteristic	Requirement					Method of Test, Ref to (P :) of IS : 1448*
		Grade VG 32	Grade VG 46	Grade VG 68	Grade VG 100	Grade VG 150	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
xii)	Air release value, minutes to 0·2 percent volume air-content at 50°C, *Max*	7	10	15	20	25	P : 102
xiii)	†Seal compatibility test						Appendix A
	a) Volume change	← ± 4 percent →					
	b) Change in shore hardness	← − 1 to + 4 →					
xiv)	†FZG-Niemann EP test, pass load stage, *Min*	← 8th →					P :

*Methods of test for petroleum and its products.

†These are the type tests for which manufacturers/suppliers shall give the guaranty for their compliance.

‡Under preparation. Till such time ASTM D 943-76 shall be followed.

§Under preparation. Till such time IP 281/77 shall be followed.

‖Under preparation. Till such time CEC L-07-A-71 or DIN 51354 shall be followed.

APPENDIX A

[*Table* 1, *Sl No.* (xiii)]

SEAL COMPATIBILITY TEST

A-1. SCOPE

A-1.1 This method determines the compatibility of petroleum oils with nitrile rubber seal material in terms of change in volume percent and shore hardness.

A-2. DEFINITION

A-2.1 Percent Volume Change — It is the difference between the volume of the nitrile rubber specimen before and after the test and its ratio to the volume before the test started, multiplied by 100.

A-2.2 Change in Shore Hardness of Nitrile Rubber Specimen — It is the difference in hardness between the initial and after test determined by shore hardness tester.

A-3. SUMMARY OF METHOD

A-3.1 The initial volume and hardness of the nitrile rubber specimen is determined. The specimen is then immersed in the oil for a period of 100 hours at a temperature of 80 ± 20°C. After the test duration, the specimen is cooled to room temperature and change in volume and hardness is determined.

A-4. APPARATUS

A-4.1 Nitrile Rubber Specimen* — This shall be in the form of disc of 36 mm diameter and 6 mm thickness of NBR/101 (nitrile-butadiene rubber).

A-4.2 Analytical Balance — Having sensitivity of 0·1 mg with nylon filament and a beaker containing distilled water on a bridge as shown in Fig. 1.

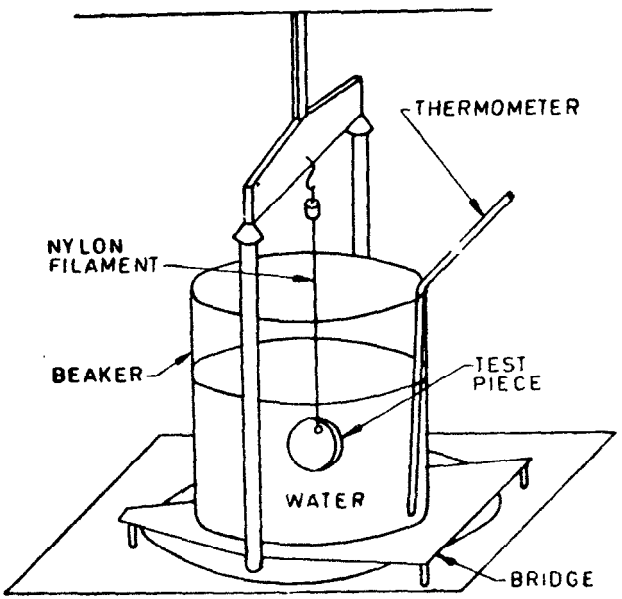

FIG. 1 ANALYTICAL BALANCE FOR WEIGHING IN AIR AND WATER

*Available from Firma Carl Freudenberg GmBH, Post Box 1380, Bergstrasse 694 Weinheim, West Germany. IOC (R&D) Faridabad may be contacted for the supply of these seals.

A-4.3 Shore Hardness Tester

A-4.4 Glass Jar — Having a ground glass stopper and of dimensions such that the rubber test specimens remain completely immersed in the fluid under test, and free to swell without restraint or distortion. The diameter of the mouth should be such as to allow free entry and exit of specimens.

A-4.5 Oven — A fan-assisted air circulating oven capable of maintaining temperature within $\pm$ 2°C.

A-5. PROCEDURE

A-5.1 Use three rubber test specimens, weigh each piece in air to the nearest milligram (M_1) and then reweigh each test piece in distilled water (M_2) at the standard laboratory temperature, care being taken to ensure that all air bubbles are removed, Formation of air bubbles may be avoided by dipping the test piece momentarily into a suitable liquid such as methyl alcohol.

A-5.2 Blot the test pieces dry with filter paper or piece of textile that does not deposit lint.

A-5.3 Measure the hardness of the three test pieces at different points of each test specimen. Mean value of the specimen should be taken.

A-5.4 Immerse the rubber test specimens vertically and keep them separate in the glass jar containing petroleum oil. The amount of oil should be at least 15 times the combined volume of the test pieces and sufficient to keep them totally immersed. Replace the sttoper and put the jar and contents in test oven for 100 hours at 80 $\pm$ 2°C.

A-5.5 At the end of 100 hours bring the jar and contents to the standard laboratory temperature.

A-5.6 Remove any surplus oil from the surface of the test piece. For complete removal of oil, dip each test piece momentarily in suitable volatile liquid such as petroleum ether and again quickly wipe with filter paper or a piece of textile which does not deposit lint.

A-5.7 Place the test piece immediately in a tared and stoppered weighing bottle and determine its mass in air (M_3) to the nearest milligram at the standard laboratory temperature.

A-5.8 Remove test piece from the bottle and immediately weigh in distilled water (M_4) at the standard laboratory temperature.

A-5.9 Measure the hardness of specimens after **A-5.8** as described in **A-5.2**.

A-6. METHOD OF CALCULATION

A-6.1 Volume change, percent $= \frac{(M_3 - M_4) - (M_1 - M_2) \times 100}{(M_1 - M_2)}$

where

M_1 = the initial mass of the rubber specimen in air,

M_2 = the initial apparent mass of rubber specimen in water,

M_3 = the mass in air of the rubber specimen after immersion, and

M_4 = the apparent mass in water of the rubber specimen after immersion.

A-6.1.1 The arithmetic mean of three measurements should be taken.

A-6.2 Change in Shore Hardness = Initial mean hardness of the rubber specimen — Mean hardness of the rubber specimen after immersion.

A-7. PRECISION OF THE TEST METHOD

A-7.1 Precision of the test method is yet to be established.

(*Continued from page* 2)

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